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**TITLE PAGE**

A CASE SERIES TO INVESTIGATE FOOD-RELATED FEAR LEARNING AND  
EXTINCTION USING *IN-VIVO* FOOD EXPOSURE IN ANOREXIA NERVOSA: A  
CLINICAL APPLICATION OF THE INHIBITORY LEARNING FRAMEWORK.

**Running Title**

FOOD EXPOSURE IN ANOREXIA NERVOSA

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**ABSTRACT**

Objective: Anorexia nervosa is characterized by severe malnutrition. This study tested the hypothesis that fear of food is a learned behavior and evaluated the feasibility and effectiveness of gradual exposure to food to improve eating behavior in people with anorexia nervosa. Methods: Eighteen women were recruited and completed baseline self-reports. They were interviewed regarding early experiences of eating and the development of food-related anxiety. Participants received eight sessions of in vivo food exposure. Results: Findings indicated that fear of food is a learned behavior, associated with catastrophic thoughts around the consequences of eating and safety behaviors. Patients consumed at least half of the food item selected in all, but one session. Body mass index increased and food restriction, eating concern, eating disorder-related preoccupations and overall anxiety reduced (medium/large ES). Conclusion: Findings corroborate an anxiety-based model of anorexia nervosa and support the relevance of targeting food-related fears using exposure-based protocols.

*Key words* Anorexia Nervosa, Exposure, Food, Fear, Anxiety.

Trial name: A fMRI Pilot Study of the Effects of Meal-support in Eating Disorders

### **Highlights**

- Fear of food is a core symptom of anorexia nervosa
- Patients report early experiences of learned fear of food.
- Food exposure based on inhibitory learning is acceptable and associated with clinical benefit.

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The authors do not report any financial or non-financial competing interests in relation to the work described.

**INTRODUCTION**

Anorexia nervosa is a serious mental illness (Klump, Bulik, Kaye, Treasure, 2009) and has the highest mortality rates amongst psychiatric disorders (Chesney, Goodwin, Fazel, 2014). Given the health-threatening consequences of starvation, improving nutrition and restoring weight are of key importance in the first stages of treatment (American Psychiatric Association, 2006). Fear of food is probably the most challenging obstacle to successful weight restoration (e.g. Steinglass et al., 2010; McFarlane, Olmsted, Trottier, 2008) and predicts the desire to maintain low weight after discharge above and beyond negative affect and general anxiety sensitivity (Levison, Brosch, Fewell, Lenze, 2017). The therapeutic strategies to tackle food-related anxiety vary. Empowering parents to provide meal support is successful in adolescent, short onset cases (Couturier, Kimber, Szatmari, 2013), but is more difficult in older patients. Inpatient care with nursing meal support ensures the most rapid weight gain (American Psychiatric Association, 2006; National Institute of Clinical Excellence, 2004), but patients report fear and negative emotions in relation to eating (Steinglass et al., 2010; Soussignan, Schaal, Rigaud, Royet, Jiang, 2011) and experience refeeding as a battle (Long, Wallis, Leung, Meyer, 2012). Accordingly, the high rates of relapse and readmission after inpatient treatment (Wallier, Vibert, Berthoz, Huas, Hubert, Godart, 2009; Castro, Gila, Puig, Rodriguez, Toro, 2004) are suggestive of treatment iatrogenic effects in relation to eating-related anxiety.

The importance of targeting anxiety in anorexia nervosa is supported by the genetic correlation with the neuroticism trait (Duncan et al., 2017) and by the phenotypical overlap with phobic and obsessive-compulsive disorders (Steinglass, et al., 2011). This overlap includes a hypothesized increased tendency to learn fear associations (Strober, 2004) and the development of compulsive behaviors, avoidance and irrational beliefs around the phobic stimulus (Steinglass et al., 2011). In line with an anxiety-based model of anorexia nervosa, abnormal eating behaviors might develop from direct associations between food and traumatic

experiences (classical conditioning), vicarious learning of food-related avoidance and aversion (learning of attitudes and behaviors through observing these in close others) and operant conditioning based on learning that eating is followed by aversive consequences (e.g. negative judgment from others, shame and criticism) (Treasure, Cardi, Kan, 2012). These hypotheses are supported by evidence that critical comments and teasing about eating, weight and appearance are risk factors for disordered eating (e.g. Fairweather-Schmidt and Wade, 2017; Menzel, Schaefer, Burke, Mayhew, Brannick, Thompson, 2010), and that pressures from parents, peers and the media on losing weight predict the use of extreme weight loss strategies over time (McCabe & Ricciardelli, 2005). Likewise, parental coercive control over eating has been associated with the development of disordered eating over time (e.g. Ellis, Galloway, Webb, Martz, Farrow, 2016).

Based on the proposition that fear of food is a key symptom in anorexia nervosa and that it might be underlined by some of the basic mechanisms of learning, exposure-based treatments might hold promise in the treatment of food-related anxiety and avoidance (Steinglass et al., 2011). Exposure-based treatments are evidence-based, first-line interventions for anxiety disorders and involve gradual exposure to the phobic stimulus. The first well established hypothesis regarding the mechanisms of effect of these interventions was that repeated exposure to the feared stimulus would allow habituation to anxiety and therefore fear extinction (e.g. Foa & Kozak, 1986). Recent advances in the science of learning and extinction have led to refinements of this hypothesis introducing the concept of inhibitory learning (Craske et al., 2014). The theory of inhibitory learning proposes that successful exposure therapy operates through new learning about the threatened stimulus (e.g. learning that the stimulus is not associated with aversive consequences as previously thought) rather than habituation to anxiety. Based on the inhibitory learning hypothesis, strategies such as maximizing the violation of expectancies regarding the intensity or frequency of the threatened

outcomes, exposure to multiple threatened cues at the same time, variability of the contexts in which exposure takes place and use of retrieval cues to strengthen new learning have been suggested to improve the efficacy of exposure-based therapies (Craske et al., 2014).

The potential of this rationale and strategies to enhance exposure treatment in anorexia nervosa has also been proposed (Murray, Treanor, Liao, Loeb, Griffiths, Le Grange, 2016; Reilly, Anderson, Gorrell, Schaumberg, Anderson, 2017). To date, only a handful of studies have tested the use of food exposure in anorexia nervosa and findings have indicated that it is associated with increased caloric intake and reduced anxiety (Steinglass, Albano, Simpson, Wang, Zou, Attia, Walsh, 2014; Steinglass, Sysko, Schebendach, Broft, Strober, Walsh, 2007) and also with increased body mass index when used in conjunction with D-cycloserine (an N-methyl-d-aspartate receptor modulator thought to augment glutamatergic function and increase fear extinction; Levinson et al., 2015). These studies have looked at the use of food exposure during or towards the end of inpatient treatment, have mostly involved weight recovered participants and have reported on the use of a protocol based on anxiety habituation rather than inhibition learning.

Based on the urgent need to implement and improve strategies for aftercare (Berends, et al., 2016; Cardi et al., 2017) and on the evidence-based framework of inhibition learning, the aim of this study is to test the feasibility, acceptability and preliminary effectiveness of food exposure-based therapy in a case series of women with anorexia nervosa who were not receiving hospital treatment at the time they participated. The main outcomes were: intervention adherence (i.e. number of sessions attended and amount of food consumed during each session), participants' willingness to continue with the intervention beyond the set time and changes in body mass index. A secondary aim was to validate an anxiety-based model of anorexia nervosa encompassing the following hypotheses: i) fear of food is a learned behavior,



ii) patients have catastrophic expectations regarding the implications of eating and iii) patients use a range of safety-behaviors to cope with the anxiety of eating.

## **METHODS AND MATERIALS**

### *Study design and outcome measures*

This study employed a longitudinal design. Eighteen patients with anorexia nervosa recruited from the community completed self-report assessments before and at the end of eight sessions of *in vivo* exposure to food. Number of sessions attended, whether participants brought to the session and consumed the food item that they had decided to be exposed to during each session and willingness to continue with the intervention beyond the sessions offered were recorded and interpreted as an index of feasibility. Body mass index was measured by the researcher at baseline and end of treatment. At these same two-time points, eating disorders symptoms, mood and confidence to change were assessed using self-report measures. In each session, participants were asked to rate their anxiety on a visual analogue scale during food consumption.

### *Participants*

Women (19 to 60 years) with a diagnosis of anorexia nervosa according to the Diagnostic and Statistical Manual of Mental Disorders (5th edition; American Psychiatric Association, 2013) who were not receiving inpatient or outpatient treatment at the time of recruitment and who were proficient in English and right-handed were eligible to take part in the study. A tailored version of the SCID-I (First et al., 2002) (i.e. overview, screening and eating disorder modules, open questions on past or present history of anxiety and mood disorders) was used to ascertain that participants met the inclusion criteria. Twenty subjects with anorexia nervosa were assessed. Two patients did not start the intervention due to

difficulty in attending weekly appointments (N=1) and an unexpected admission to hospital (N=1). All patients were receiving regular physical monitoring by their general practitioners.

Participants were recruited from the community through advertisements posted on eating disorder charities websites (i.e. Beating Eating Disorders and SUCCEED), circular emails to students and staff at King's College London (KCL) and emails sent to individuals from the volunteer database of the Eating Disorders Research Unit at KCL. After complete description of the study, written informed consent was obtained. The study was approved by a National Research Ethics Service (NRES) committee (i.e. South West London Research Ethics Committee; approval number: 11/LO/0373). The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

### *Intervention*

Participants received two assessment and psycho-education sessions and eight, 60-minute sessions of food exposure-based therapy. The assessment sessions consisted in: i) completion of the baseline questionnaires, ii) description of the study rationale (i.e. learning processes involved in food-related fears, role of food-related fears in the maintenance of anorexia nervosa, anxiety and its time course, role of avoidance, irrational fears and safety behaviors, fear learning and inhibition) and iii) case formulation to assess traumatic experiences related to food, eating disordered behaviors in the family, family's eating attitudes, imagined worst consequences associated with eating "scary" foods (i.e. irrational beliefs around eating), safety behaviors currently used to manage food-related anxiety and threatening foods to tackle. The intervention was developed by the study team (VC, JT, DMC) with supervision from an expert trainer (DMC) and it was based on the clinical

recommendations derived from the inhibitory learning framework (Craske, Hermans, Vervliet, 2018). The sessions were delivered by a clinical psychologist with experience in eating disorders (VC) and occurred on average twice/week. Based on the inhibitory learning framework, particular emphasis was given to: paying attention to the feared stimulus, maximizing the mismatch between frequency and intensity of expected negative consequences of exposure to the threatening stimulus and actual consequences, affect labelling, exposure to different food items during each session, supportive and non-judgmental attitude from the therapist and encouragement to undertake self-exposure sessions in own environments to generalize the learning occurred during the sessions. The last therapy session included a summary of skills learned and included a plan for maintaining the changes made.

#### *Assessment measures*

The following questionnaires were administered at baseline and end of intervention:

- Eating disorder symptoms (Eating Disorders Examination – Questionnaire; EDE-Q; Fairburn & Beglin, 1994).
- Depression, anxiety and stress (Depression Anxiety and Stress Scale; DASS 21; Lovibond & Lovibond, 1995). Only anxiety subscale considered in the study.
- Confidence to change: (visual analogue scale ranging from 0 - not at all - to 10 - very much).
- Preoccupations and rituals around eating (Yale-Brown-Cornell Eating Disorder Scale; YBC-EDS; Mazure, Halmi, Sunday, Romano, Einhorn, 1994).

At baseline and after the end of the intervention, the researcher measured participant's body mass index. Anxiety during food consumption was measured in each session on a scale ranging from 0 ("not anxious at all") to 10 ("extremely anxious"). At the end of the final

session, participants were asked the question: “If given the opportunity, would you choose to continue with this intervention?”. Finally, the therapist recorded the number of sessions attended and whether participants brought in and ate the food item chosen during each exposure session.

#### *Data Analyses*

Statistical analyses were conducted using SPSS version 20. Mean and standard deviations of demographic and clinical characteristics were calculated. Paired *t*-tests were used to compare pre- and post-intervention scores for the primary and secondary outcomes in the patient group. A *p* value of 0.05 was considered to be significant. Cohen’s *d* effect sizes (*ES*) (Cohen, 1992) were calculated and described as negligible ( $= 0$  and  $< 0.15$ ), small ( $\geq 0.15$  and  $< 0.40$ ), medium ( $\geq 0.40$  and  $< 0.75$ ), large ( $\geq 0.75$  and  $< 1.10$ ), very large ( $\geq 1.10$  and  $< 1.45$ ) and huge ( $> 1.45$ ).

## RESULTS

### *Sample description*

Patients' mean age was 32.83 ( $SD=12.67$ ). The mean body mass index was "severely low" (Mean=15.98,  $SD=1.28$ ) (American Psychiatric Association, 2013) and they reported clinically significant levels of eating disorder symptoms, anxiety, depression and stress. Six patients had a comorbid diagnosis of anxiety disorders (i.e. social anxiety disorder, or panic disorder, or generalized anxiety disorder or obsessive-compulsive disorder) and nine of major depression. Ten people were using antidepressants at the time of their participation. The mean duration of illness was 15.88 years ( $SD=11.07$ ; min = 1; max = 36; N = 15 patients > 3 years). Patients did not change the dose of medication or receive any other psychological or nutritional treatment for the duration of their participation in the project. The baseline clinical data are reported in Table 1.

-----Table 1-----

### *Experiences of fear learning, expectations and safety behaviors*

The following areas were investigated during the assessment sessions: 1) traumatic experiences related to food, eating disordered behaviors in the family, family's eating attitudes; 2) imagined worst consequences associated with eating "scary" foods (i.e. expected outcomes of eating); 3) safety behaviors currently used to manage food-related anxiety. None of the patients reported traumatic experiences involving food and eating prior to illness onset. However, 14 reported witnessing fear and anxiety around eating in at least one of their primary carers and 13 reported having experienced the use of rigid rules about food intake in their family prior to illness onset. The most frequent responses to the question "what is the worst consequence of eating?" were: 'fear of losing control', 'fear of changing shape

immediately after eating', 'fear of feeling distressed', 'fear of feeling disgusted' and 'fear of being disgusting' (figure 1a). These expectations were discussed and disconfirmed during the sessions. Finally, when participants were asked about the types of safety behaviors used, a broad range of behaviors was identified (figure 1b).

-----Figures 1a, 1b here-----

#### *Exposure sessions: attendance, food consumption, anxiety ratings and acceptability*

All participants completed eight sessions of therapist-guided exposure to food stimuli and one exposure session/week at home. None dropped-out from the intervention and all expressed an interest in continuing beyond the agreed timeline. Over the sessions, participants were encouraged to eat always a different food item listed on their threatening foods' hierarchy. All patients consumed at least half of the food item selected during the sessions, except for one participant who did not consume any food in session two. Patients did not habituate to eating-related anxiety over time, as demonstrated by the average anxiety scores reported during food consumption (figure 2).

In response to the question "If given the opportunity, would you choose to continue with this intervention?", all participants, but one reported that they would. The one person who said they wouldn't, mentioned that travelling to the sessions was physically exhausting.

-----Figure 2-----

#### *Clinical change associated with the treatment*

Baseline-to-end of treatment changes associated with the intervention are reported in table 1. Overall, a significant increase in body mass index was found. A significant reduction in food restriction and eating concern, eating disorder-related preoccupations and anxiety (medium *ES*) were found. Increased confidence to change was also observed (large *ES*).

## DISCUSSION

### *Summary of findings*

The aim of the current study was to provide evidence for the feasibility, acceptability and preliminary effectiveness of an *in vivo* food exposure intervention in patients with anorexia nervosa. Overall, the findings supported the acceptability of the intervention, in that none of the patients dropped-out and that in all but one session, patients consumed at least half of the food item selected. The quantitative data demonstrated that body mass index increased and that food restriction, eating concern, eating disorder-related preoccupations and overall anxiety reduced (medium to large *ES*). Confidence to change also improved from the beginning to the end of the sessions (large *ES*). The latter finding is particularly relevant to explain the mechanisms of effect of exposure therapy, suggesting the potential involvement of complex cognitive processes, such as self-efficacy (i.e. belief about own' ability to cope with the feared stimulus) (e.g. Craske, Kircanski, Zelikowsky, Mystkowski, Chowdhury, Baker, 2008). The data collected during the assessment phase further validates the use of food exposure therapy in anorexia nervosa. Premorbid experiences of abnormal (vicarious) learning associated with eating were recalled by the majority of the patients and might contribute to the development of food-related anxiety and avoidance. Patients also reported catastrophic consequences about the consequences of eating and a large number of safety behaviors to manage the anxiety related to food.

These findings overall align to the literature regarding the phenotypic overlap between anorexia nervosa and anxiety disorders (Steinglass et al., 2011) and suggest the possibility to treat food-related fears and anxiety using *in vivo* exposure based on inhibitory learning (Craske et al. 2014). Participants in this study reported that they felt empowered and in control of the therapy, as probably reflected in the significant increase in confidence to change obtained at the end of it. Throughout the intervention, they were encouraged to take

responsibility of the sessions, by selecting which food to buy, buying it and deciding how much to eat. On the other hand, the role of the therapist was to encourage them to keep the focus on the food, label the difficult emotions experienced and to highlight the mismatch between feared and actual outcomes of the exposure. In anorexia nervosa, this could represent a potential conundrum, considering that weight gain is often the most threatening consequence of eating, as well as one of the most important treatment goals. A successful approach to this was to highlight the mismatch between the *specific* characteristics of the expected weight gain (e.g. how much, how quickly and what implications it would have), rather than weight gain as such, and the actual outcomes of eating during the sessions. Fear of losing control over food was also very often reported by participants and disconfirmed when reflecting on the actual amount of food consumed during each session.

The results obtained in this study are particularly relevant because they indicate that new learning can develop despite the aversive consequences of starvation and malnutrition and that patients are willing to take controlled risks when confronting eating-related fears and breaking habits. The use of an experimental approach to clarify who might benefit the most from the use of food exposure protocols, based on idiosyncratic differences in fear learning and extinction might further contribute to strengthen the rationale and clinical effectiveness of this approach to psychopathology.

### *Clinical implications*

Several studies highlight the importance of weight gain in the early phase of treatment for long term recovery in anorexia nervosa (Madden, Miskovic-Wheatley, Wallis, Kohn, Hay, Touyz, 2015; Nazar, Gregor, Albano, Marchica, Lo Coco, Cardi, Treasure, 2017). The subjective implications that this has for patients have been less described. It is likely that rapid weight gain in the early phase of treatment will need to be balanced with the



consequences of patient's perceived (or actual) coercion, such as feelings of depression and suicidality (Norrington, Stanley, Tremlett, Birrell, 2012) and also with the sustainability of change after discharge (Garber et al., 2016), a time when discontinuous care jeopardizes treatments gains. The tension between early, effective weight gain and acceptable, sustainable refeeding practices posits a challenge for those involved in the treatment of anorexia nervosa. Teaching patients, carers and hospital staff members the principles of inhibition learning and techniques of food exposure to better manage mealtimes could maximize clinical change both in the early phase of treatment and aftercare, to ensure that changes are maintained over time.

The use of novel technologies, such as virtual reality, holds great promise in delivering exposure therapy. In eating disorders, virtual cue exposure to target urge to binge and anxiety associated with binge cues has been successfully used in the treatment of patients with binge eating (bulimia nervosa or binge eating disorders) who did not respond to standard CBT (Ferrer-Garcia, et al., 2017). Furthermore, the use of virtual reality to "update" negative body representations stored in memory has been shown to improve the efficacy of CBT at one year in obese patients with binge eating disorder (Cesa et al., 2013; Manzoni et al., 2016).

The use of virtual reality in anorexia nervosa hasn't been researched as much. Two early case studies indicated that the use of virtual reality to enhance outcomes from standard treatment for anorexia nervosa, was associated with weight gain, decreased eating disorder symptoms and psychological distress (Cardi, Krug, Perpiñá, Mataix-Cols, Roncero, Treasure, 2012) and with increased body awareness and reduced body dissatisfaction (Riva, Bacchetta, Baruffi, Rinaldi, Molinari, 1999). Two recent studies indicated that one session of immersive virtual reality jogging led to a reduction of the urge to exercise (Paslakis, Fauck, Röder, Rauh, Rauh, Erim, 2017) and that one session of full body illusion reduced body size estimation up to 2-3 hours after exposure (Keizer, van Elburg, Helms, Dijkerman, 2016).

Based on the inhibitory learning framework (Craske et al., 2014), virtual exposure to food would be particularly advantageous considering the potential of using multiple different cues and environments over time to favor new learning, whilst ensuring high controllability of the variables in an experimental setting.

### *Strengths and limitations*

The main strength of this study is the investigation of a non-standard and yet illness-specific treatment approach in a sample of patients with anorexia nervosa who were not receiving any other treatments at the time of recruitment. A limitation of this study is the lack of a comparison group of patients who did not receive the intervention. In the preparation phase for this study, we tested the possibility of randomizing patients to either receiving the intervention or being on a waiting list. The first three patients randomized to the waiting list condition declined to participate further and we decided to proceed with a case series, feasibility study. Patients with eating disorders seem to have strong treatment preferences (Halmi et al., 2005). Indeed, different forms of interventions such as cognitive-behavioral therapy, specialist supportive clinical management (SSCM), the Maudsley Anorexia Nervosa Treatment for Adults (MANTRA) and psychodynamic therapies have been used as comparators in treatment trials of anorexia nervosa, rather than waiting lists (Hay, Claudino, Touyz, Abd Elbaky, 2015). A possibility to test food exposure in anorexia nervosa using a randomized controlled trial design, would be to identify patients characterized by abnormal food-related fear learning and inhibition and randomize them to either treatment as usual enhanced by food exposure or treatment as usual alone.

### *Conclusion*

364           Fear and anxiety around of food are the core psychopathological feature of anorexia  
365   nervosa and the greatest obstacle to successful refeeding. Gradual exposure to food is  
366   feasible, acceptable and associated with preliminary clinical change in patients with anorexia  
367   nervosa who are living in the community. The use of translational research to increase the  
368   understanding of individual differences in fear learning and extinction, and the employment  
369   of novel technologies such as virtual reality to deliver exposure therapy are promising  
370   approaches to improve current treatments for eating disorders.

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## 522 **AUTHOR CONTRIBUTIONS**

523 VC designed the study under the supervision of JT and IC. DMM and JT provided clinical  
524 guidance in the development and delivery of the intervention. JL, MS, AS and OOD provided  
525 guidance in the development of the methods and conducted the statistical analyses of  
526 neuroimaging data. JT, IC, OOD revised the manuscript and provided expert guidance during  
527 manuscript preparation. VC conducted the assessments and clinical sessions with the patients.

528

529

## 530 **ADDITIONAL INFORMATION**

531 The authors report no competing financial interests.

532 **TABLES**

Table 1 Pre and post-intervention clinical scores

Pre- (t1) and post- (t2) intervention scores on body mass index, subscales and total score of the Eating Disorder Examination Questionnaire (EDE-Q), anxiety subscale of the Depression, Anxiety and Stress Scales (DASS), eating disorders (ED)-related preoccupations and rituals and confidence to change ruler. Data expressed as means and standard deviations (SD). Statistics for paired samples *t*-tests and effect sizes are reported. Bonferroni correction applied ( $p = < .01$  for the EDE-Q subscales;  $p = < .025$  and ED-related preoccupations and rituals). Significances surviving Bonferroni correction marked with \*.

	Mean t1	SD t1	Mean t2	SD t2	Statistics	<i>p</i> values	Effect size
Body Mass Index	15.98	1.28	16.47	1.54	$t(17) = -2.8$	.001*	0.70
EDE-Q Eating Concern	3.90	1.01	3.30	1.25	$t(17) = 2.80$	.001*	0.67
EDE-Q Restraint	4.27	1.60	3.53	1.61	$t(17) = 2.76$	.001*	0.63
EDE-Q Shape Concern	4.53	1.26	4.15	1.46	$t(17) = 1.25$	.22	0.29
EDE-Q Weight Concern	3.97	1.58	3.52	1.58	$t(17) = 1.14$	.26	0.26
EDE-Q Total score	4.17	1.19	3.62	1.31	$t(17) = 2.39$	.002*	0.56
ED-related preoccupations	11.76	2.79	10.11	3.73	$t(17) = 2.61$	.02*	0.67
ED-related rituals	10.17	3.66	9.64	3.46	$t(17) = .90$	.37	0.22
DASS Anxiety	17.88	7.74	13.66	7.67	$t(17) = 3.49$	.003	0.80
Confidence to change	5.31	1.85	6.68	2.27	$t(17) = -3.22$	.006	0.81

541 **FIGURES LEGEND**

542 Figure 1 Feared consequences of eating and use of safety behaviours

543 (a) Number of participants reporting specific feared consequences of eating (“fear of  
544 appearing disgusting”, “fear of experiencing disgust”, “fear of experiencing intense distress”,  
545 “fear of changing shape very quickly” and “fear of losing control”) and (b) number of  
546 participants reporting the use of safety-behaviours to manage food-related anxiety.

547

548 Figure 2 Anxiety associated with eating during the sessions

549 Participants’ anxiety ratings during food consumption in each session.

550